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Polistes associus (Kohl, 1898) recorded from Slovakia after 66 years (Hymenoptera, Vespidae)

Katarína Goffová[1], Dáša Matisková[1], Dávid Selnekovič[1], Adrián Purkart[1], Vladimír Smetana[2]

1 Faculty of Natural Sciences, Department of Zoology, Comenius University in Bratislava, Bratislava, Slovakia • KG: katarina.goffova@uniba.sk https://orcid.org/0000-0001-9890-8479 • DM: d.matiskova@gmail.com • DS: david.selnekovic@uniba.sk https://orcid.org/0000-0002-9228-1174 • AP: purkart.adrian@gmail.com

2 Tekov Museum, Levice, Slovakia • vladimir.smetana@muzeumlevice.sk

* Corresponding author

Abstract

We present the second record of *Polistes associus* (Kohl, 1898) (Hymenoptera, Vespidae) from Slovakia after 66 years and discuss the distribution of this species in Europe. Morphological features of the species are compared with those of other morphologically similar congeners occurring in Central Europe, *Polistes bischoffi* Weyrauch, 1937 and *Polistes nimpha* (Christ, 1791), and the differential diagnoses are supplemented with figures.

Keywords

Distributional range, Europe, faunistics, identification, paper wasps, Polistinae, Project LIFE

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Introduction

The genus *Polistes* Latreille, 1802 is among the largest genera within the family Vespidae, with more than 200 species described (Carpenter 1996; Neumeyer et al. 2014). Eleven species occur in Europe, and seven have been reported from Slovakia (Dvořák and Straka 2007).

Because of numerous nomenclatural changes, published data on the distribution of the genus *Polistes* in Slovakia are rather confusing (Schmid-Egger et al. 2017). In the second half of the 20th century, a single study on paper wasps of Czechoslovakia was published by Bouček and Šustera (1956). The species presented by these authors as *P. gallicus* (Linnaeus, 1767) is now known as *P. dominula* (Christ, 1791). Moreover, Bouček and Šustera (1956) mentioned *P. foederatus* Kohl, 1898, which Dvořák and Straka (2007) later treated as *P. gallicus* following the taxonomy of the group at that time. Dvořák and Straka's (2007) *P. gallicus* is now understood to be *P. bischoffi* Weyrauch, 1937 (Schmid-Egger et al. 2017), which we discuss here. *Polistes bischoffi* was reported from Slovakia by Dvořák and Smetana (2007) as *P. gallicus* according to an outdated taxonomic concept. On the contrary, the species reported from Slovakia as *P. bischoffi* by Dvořák and Smetana (2007) is now understood as *P. albellus* Giordani Soika, 1976. Moreover, *P. associus* (Kohl, 1898) has not been recorded in Slovakia for more than 50 years.

Polistes associus is undoubtedly one of the rarest paper wasps in Slovakia, having been previously reported only from a single locality, Remetské Hámre, in eastern Slovakia (Dvořák 2005). This locality represents

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the northernmost site (48.8333°N) within the species' distributional range (Dvořák 2005; Dvořák and Roberts 2006). *Polistes associus* occurs primarily within the lower latitudes in the Western Palearctic region, reaching Israel in the south (Bytinski-Salz and Gusenleitneh 1971) and Azerbaijan in the east (Guiglia 1972; Carpenter 1996; Neumeyer et al. 2014). Guiglia (1972) also mentioned its occurrence in India (Jammu and Kashmir) and China. In Europe (Fig. 1A), it is currently known from Spain (Schmid-Egger et al. 2017), France (Leclercq 1955; Schmid-Egger et al. 2017), Italy (Zimmermann 1930; Castellani 1937; Weyrauch 1939; Giordani Soika1944; Schmid-Egger et al. 2017), Switzerland (Neumeyer et al. 2014), Austria (Kohl 1898), Hungary (Móczár 1995), Slovakia (Dvořák 2005), Croatia (Blüthgen 1943; Neumeyer et al. 2014; Schmid-Egger et al. 2017), Montenegro (Schmid-Egger et al. 2017), Albania (Guiglia 1972), Greece (Kohl 1898; Blüthgen and Gusenleitneh 1970; Schmid-Egger et al. 2017), Macedonia (Schmid-Egger et al. 2017), Bulgaria (Schmid-Egger et al. 2017), and Turkey (Guiglia 1972).

In this paper we present a recent occurrence of *P. associus* in Slovakia, which is only the second record of this species in 66 years. We also summarize the distributional data of *P. associus* in Europe, and we compare the main morphological characteristics of the species with

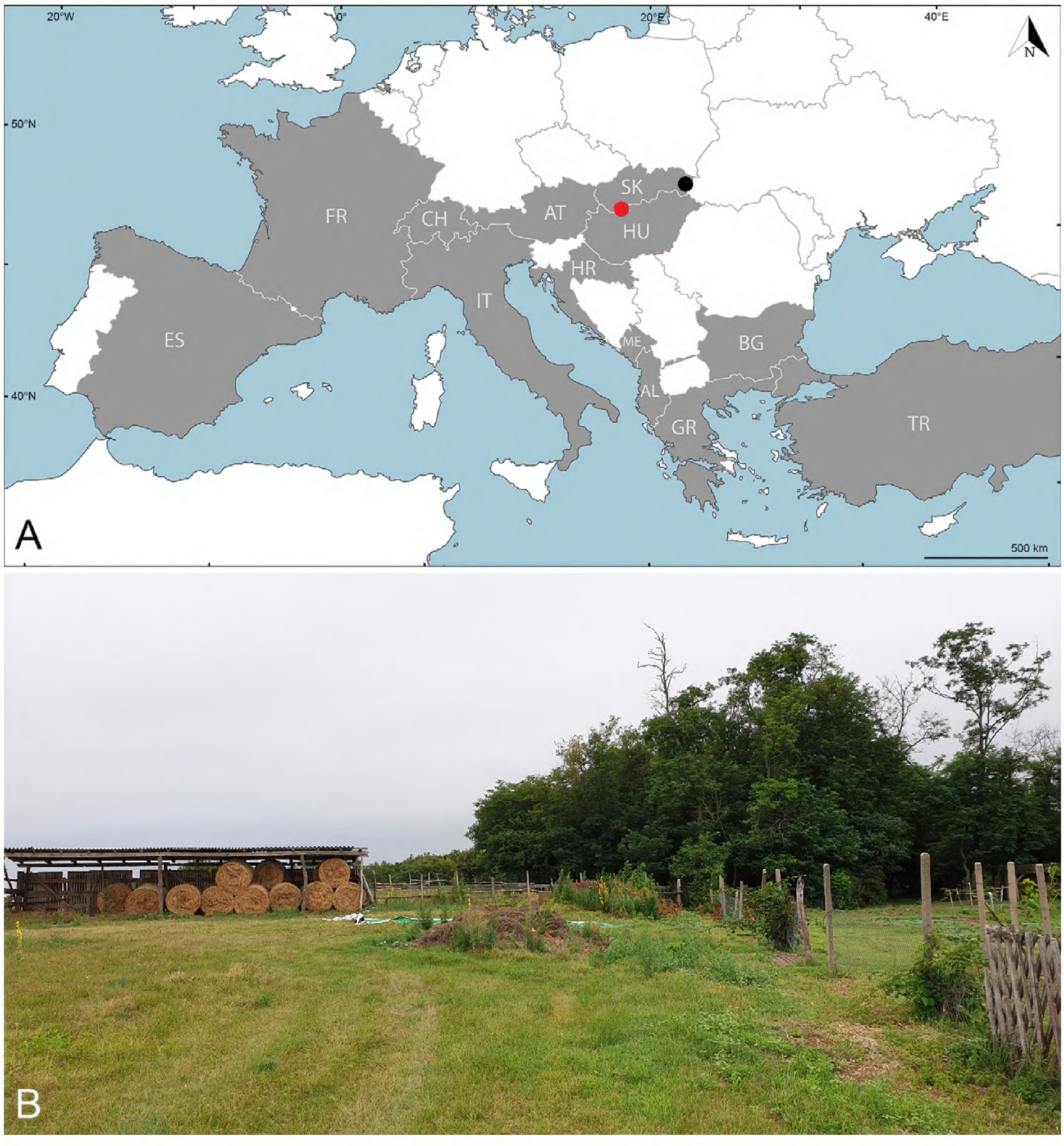

Figure 1. Distribution and habitat of *Polistes associus* (Kohl, 1898). **A.** Distribution in Europe (countries with reported occurrence are highlighted in grey), black circle: the historical record from Remetské Hámre in 1952 (Dvořák 2005), red circle: the recent record in Radvaň nad Dunajom in 2018. **B.** The habitat where specimens were collected by Malaise trap.

those of morphologically similar congeners occurring in Central Europe.

Methods

Insects were collected during the comprehensive faunistic research near the village of Radvaň nad Dunajom in southern Slovakia, a part of the Special Protection Area Dolné Pohronie in NATURA 2000 network (Fig. 1B). Specimens were obtained using a Malaise trap installed from 12 April to 19 October 2018. Specimens of *Polistes* were captured during 4–15 August 2018. Specimens were preserved in 75% ethanol and later dry mounted. Specimens were photographed under a Zeiss Axio-Zoom V-16 stereomicroscope using diffuse LED lighting and a Canon 5D Mark IV camera. The high-resolution photographs were stacked using the Zerene Stacker v. 1.4 software and graphically edited in Adobe Photoshop CS5 Extended v. 12.1. Specimens were identified following the keys provided by Guiglia (1972), Dvořák and Roberts (2006), Neumeyer et al. (2014), and Schmid-Egger et al. (2017). The nomenclature used here follows Schmid-Egger et al. (2017). Voucher specimens are deposited in the Katarína Goffová collection (**KGBS**) at the Department of Zoology, Comenius University in Bratislava Faculty of Natural Sciences, Bratislava, Slovakia.

Results

Family Vespidae Latreille, 1802

***Polistes associus* (Kohl, 1898)**

New record. SLOVAKIA • 1 ♂; Radvaň nad Dunajom, Special Protection Area Dolné Pohronie, sand dune; 47.7608°N, 018.3370°E ; 115 m a.s.l.; 4–15 August 2018; Katarína Goffová leg.; Dáša Matisková, Vladimír Smetana det.; Malaise trap; KGBS.

Identification. Males of *P. associus* (Fig. 2A–C) can be separated from other congeners by several characters on the head such as narrow temples (genae) in dorsal view; clypeus strongly depressed in distal one-half (Fig. 2C.I) with distinct lateral ridges (Fig. 2C.II) and with more or less truncate anterior margin (Fig. 2C.III) (Neumeyer et al. 2014; Schmid-Egger et al. 2017); frons with a distinct longitudinal depression medially (Fig. 2C.IV) (Schmid-Egger et al. 2017). The apical antennal segment is about 3.0× as long as wide (Fig. 2B.I) and apical one-half of the antenna is usually distinctly darkened dorsally (Fig. 2B.II) (Schmid-Egger et al. 2017). Abdominal sternites III–VII usually with transverse yellow band basally (Fig. 2A), and the last sternite often partly yellow (Fig. 2A; apparent when sternites extruded) (Schmid-Egger et al. 2017). Males of *P. associus* resemble *P. gallicus* and *P. bischoffi* in having the clypeus narrowed anteriorly and the temples narrowed posteriorly, but *P. associus* can be distinguished from *P. gallicus* and *P. bischoffi* by having the longitudinal ridges on clypeus (Dvořák and Roberts 2006). The head in *P. associus* and *P. nimpha* (Christ, 1791) is much more similar in males than in females. The differences in the male head between *P. associus*, *P. bischoffi*, and *P. nimpha* are documented in Figure 2B, E, G.

The females of *P. associus* closely resemble those of *P. nimpha* (Fig. 2F). They can be separated mostly by differences in coloration, but *P. nimpha* often exhibits higher levels of color variation (Schmid-Egger et al. 2017). Moreover, *P. nimpha* has different ocellar disposition than *P. associus*. *Polistes associus* has roughly equidistant ocelli, as opposed to *P. nimpha* having the two posterior ocelli slightly further away from each other than from the anterior ocellum (Guiglia 1972; Schmid-Egger et al. 2017). In the non-parasitic species of the *P. dominula* species group (*P. associus*, *P. dominula*, and *P. bucharensis* Erichson, 1849), the yellow band behind the carina is always wider than in other congeners. However, some extremely xanthic females of *P. nimpha* from western Asia also possess a very wide pronotal band. Posterolateral yellow bands of the pronotum in *P. associus* are usually not connected to the anterior transverse band; the anterior transverse yellow band is as wide medio-laterally as dorso-laterally or wider, and the mesoscutum is with paired yellow spots (Schmid-Egger et al. 2017). Other characters on the head are as important. Females of *P. associus* have a transverse black band on the clypeus (Schmid-Egger et al. 2017), although Central European specimens often have black markings just in the center of the clypeus (Dvořák and Roberts 2006). Gusenleitner (1995) reported some females from Austria that lacked a transverse stripe on the clypeus. The apical half of the antenna is dorsally more or less brownish (Schmid-Egger et al. 2017). The last ventrite is entirely black, with an apical yellow or reddish spot, or it is entirely reddish. The sculpture of the ventral part of the mesopleuron is finer in *P. associus* than in *P. nimpha* (Schmid-Egger et al. 2017). Dvořák and Roberts (2006) reported that the last ventrite in *P. nimpha* can be black or with small yellow and/or reddish apical spots (Fig. 2D), while that in *P. associus* is reddish-brown with a lighter apical spot. Some Austrian specimens of *P. associus* were found to have the last ventrite colored similarly to *P. nimpha* (reddish-brown with a lighter apical spot), and they differed only by a reduced black stripe on the clypeus (Dvořák and Roberts 2006).

Discussion

Polistes associus is reported from 14 countries across Europe (Fig. 1A). The northernmost occurrence of *P. associus* in Europe is in eastern Slovakia, where only one female was found in Remetské Hámre in 1952 (Dvořák 2005). Our new record confirms the presence of *P. associus* in Slovakia after 66 years. In 2018, one male was captured in a Malaise trap in Radvaň nad Dunajom during the insect monitoring for the project

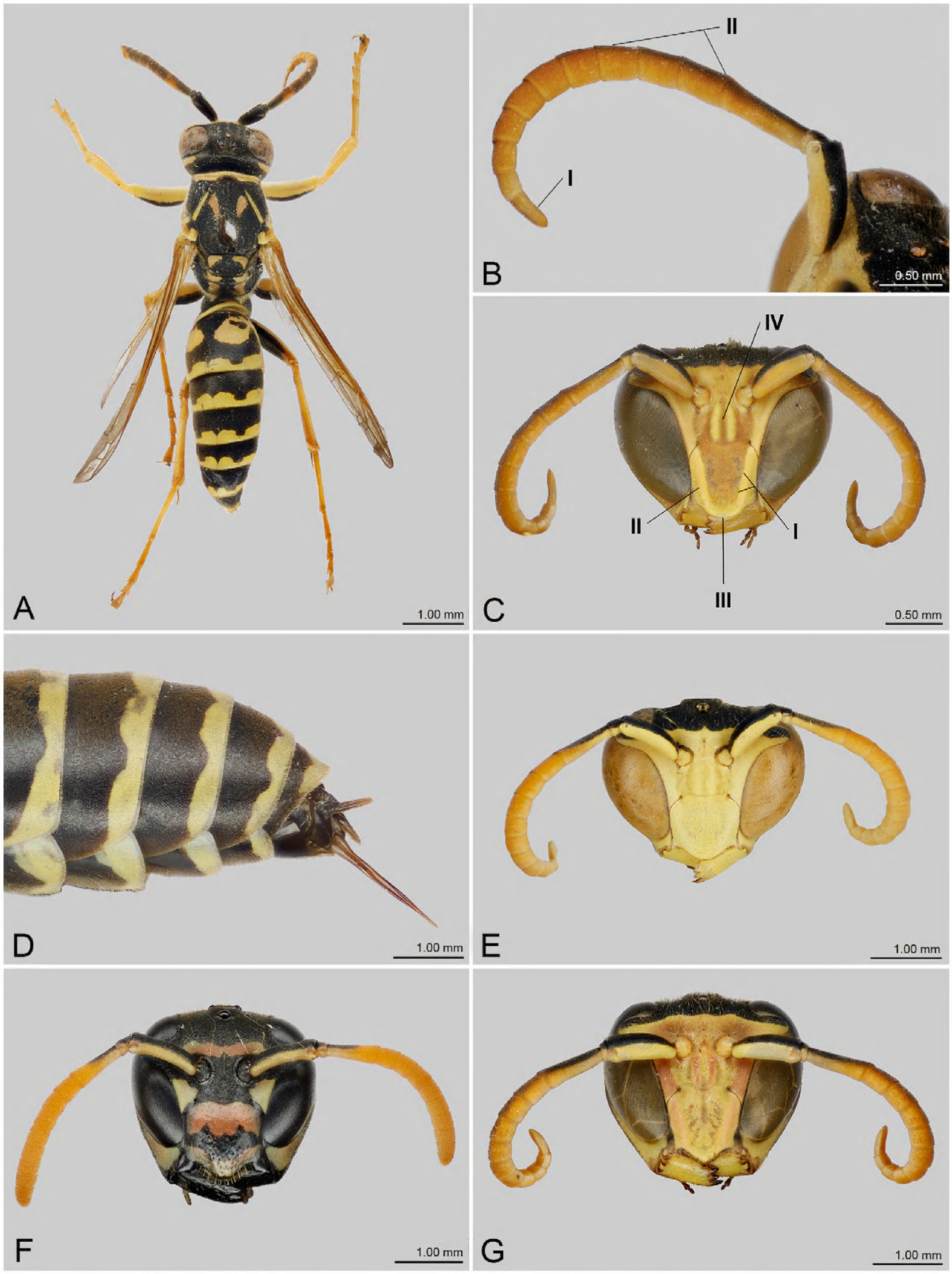

Figure 2. Diagnostic characters of three *Polistes* species caught by Malaise trap in Radvaň nad Dunajom in 2018 (Slovakia). **A.** *P. associus*, male, dorsal habitus. **B.** *P. associus*, male antenna, lateral view: I. the apical antennal segment, II. one-half of the apical antenna darkened dorsally. **C.** *P. associus*, male head, frontal view: I. strongly depressed clypeus in distal one-half, II. distinct lateral ridges on clypeus, III. truncate anterior margin on clypeus, IV. medial distinct longitudinal depression across the frons. **D.** *P. nimpha*, female abdomen, lateral view. **E.** *P. bischoffi*, male head, frontal view. **F.** *P. nimpha*, female head, frontal view. **G.** *P. nimpha*, male head, frontal view.

LIFE BeeSandFish focused on the feeding spectrum of the bird *Merops apiaster* Linnaeus, 1758. The new locality is located more than 300 km west from the previous Slovakian site at Remetské Hámre (Dvořák 2005), but the nearest known locality to our new locality is in Budapest, Hungary (Répási et al. 2009), less than 60 km southeast of Radvaň nad Dunajom. In Austria, the nearest locality is Perchtoldsdorfer Heide, a natural area near Vienna (Gusenleitner et al. 2014), which is about 160 km northwest of Radvaň nad Dunajom.

The species morphologically similar to *P. associus*, such as *P. bischoffi*, *P. gallicus*, and *P. nimpha* are reported from Slovakia as well, and their distributions overlap (Dvořák and Straka 2007; Dvořák and Smetana 2007). Dvořák et al. (2006) published a study on the distribution of *P. bischoffi* in the Czech Republic and Slovakia, although according to Schmid-Egger et al. (2017) the data actually refer to *P. albellus*. On the other hand, the distributional records of *P. gallicus* from Slovakia published by Dvořák and Smetana (2007) probably refer to *P. bischoffi*, according to Schmid-Egger et al. 2017. During our research, *P. bischoffi* (Fig. 2E) and *P. nimpha* (Fig. 2D, F, G) were also recorded at our site at Radvaň nad Dunajom and in the same sample.

It can be difficult to separate *P. associus* from the females of *P. nimpha*, especially in the areas where both species occur sympatrically (e.g., Croatia). The color pattern of *P. associus* can be used as a diagnostic character to distinguish between the two species as it varies little. The transverse pronotal band is wide laterally, separated from the posterior band by 2–3 times the diameter of the anterior ocellus. The mesoscutum bears two large, drop-shaped, yellow spots (Schmid-Egger et al. 2017). Some specimens of *P. associus* from Austria were found to have the last ventrite colored similarly to *P. nimpha* and differ only by having a reduced black stripe on the clypeus (Dvořák and Roberts 2006). The female of *P. associus* recorded in Slovakia has a reddish-brown last ventrite and a yellow clypeus with several small black spots arranged into a short stripe in the middle of the clypeus (Dvořák 2005). The absence of a transverse stripe on clypeus is also typical for *P. associus* females from Austria (Gusenleitner 1995).

Another way to reveal the presence of paper wasps is the identification of their petiolate nest. The nest of *P. associus* is mostly bright grey in color. The cells are small, with large openings. The nests are usually hanging with their openings oriented downwards and their stalk oriented upwards, but they can also be oriented horizontally. The nest walls are very soft and loose. *Polistes associus* builds its nests outside in warm, protected places, for example, between the panes of glass of windows, or on well-exposed walls of dwellings (Guiglia 1972). Jaeger (1933) observed the nests attached to the trunks of young fir trees and shrubs approximately 30 cm above the ground and always exposed to the east. For comparison, *P. nimpha* usually builds nests 10–20 cm above ground on various species of plants, including dwarf shrubs, and also on eaves of buildings. Contrary to *P. associus*, *P. nimpha* builds an approximately horizontal petiole so that the comb faces to the side (Blüthgen 1961). Their nest walls are not as soft as in the other *Polistes* species, but instead very elastic (Guiglia 1972). The nests of *P. bischoffi* are usually 35 cm above ground, on the outsides of buildings or hooked to a plant stem, tree trunk, or shrubs. The cells expand outwards, and middle cells are deeper than cells on the edge. Their nest is typically pear-shaped (Guiglia 1972).

Herein, we document only the second record of *P. associus* and the first record of its male from Slovakia, where other seven species of *Polistes* have been reported (Dvořák and Straka 2007). In the context of the revision by Schmid-Egger et al. (2017), we list the following species from Slovakia: *P. albellus* Giordani Soika, 1976, *P. associus*, *P. biglumis bimaculatus* (Geoffroy, 1785), *P. bischoffi*, *P. dominula*, *P. nimpha*, and *P. semenowi* Morawitz, 1889. In contrast to *P. bischoffi* and *P. nimpha*, the head of *P. associus* was not detected in the diet of *M. apiaster* in Special Protection Area Dolné Pohronie, which may indicate that *P. associus* is a rare species in southern Slovakia.

Up-to-date data on the distribution of this Mediterranean species (Ćetković 2002) in Slovakia are still missing. It may be expected that its distributional range will expand as a result of the ongoing climate change. This species has not yet been assessed for the International Union for the Conservation of Nature Red List in Europe, as it is common in the southern parts of Europe (Schmid-Egger et al. 2017). On the other hand, southern Slovakia is now on the northern edge of its distributional range, and the species is still very rare. The presence of this species at our study site shows the importance of NATURA 2000 conservation sites as refuges for insect species in Europe.

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Authors' Contributions

KG collected the specimen, prepared the manuscript, and created the map. DM identified the specimens and provided technical support. DS photographed the specimens and habitat, provided technical support, and collaborated on the manuscript preparation. AP collaborated on the manuscript preparation. VS verified the identification of the specimens and collaborated on the manuscript preparation.

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